



ENVIRONMENTAL PROTECTION AGENCY

6560-50-P

40 CFR Part 82

[EPA-HQ-OAR-2003-0118; FRL-9918-30-OAR]

RIN 2060-AG12

Protection of Stratospheric Ozone: Determination 29 for Significant New Alternatives Policy Program

AGENCY: Environmental Protection Agency (EPA).

ACTION: Determination of acceptability.

SUMMARY: This Determination of Acceptability expands the list of acceptable substitutes for ozone-depleting substances under the U.S. Environmental Protection Agency's (EPA) Significant New Alternatives Policy (SNAP) program. This action lists as acceptable additional substitutes for use in the refrigeration and air conditioning, foam blowing, and fire suppression and explosion protection sectors.

DATES: This determination is effective on [**Insert Federal Register publication date**].

ADDRESSES: EPA has established a docket for this action under Docket ID No. EPA-HQ-OAR-2003-0118 (continuation of Air Docket A-91-42). All electronic documents in the docket are listed in the index at www.regulations.gov. Although listed in the index, some information is not publicly available, i.e., Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Publicly available docket materials are available either electronically at www.regulations.gov or in hard copy at the EPA Air Docket (Nos. A-91-42 and EPA-HQ-OAR-2003-0118), EPA/DC, EPA West, Room 3334, 1301 Constitution Ave., NW, Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The

telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the Air Docket is (202) 566-1742.

FOR FURTHER INFORMATION CONTACT: Margaret Sheppard by telephone at (202) 343-9163, by facsimile at (202) 343-2338, by e-mail at sheppard.margaret@epa.gov, or by mail at U.S. Environmental Protection Agency, Mail Code 6205T, 1200 Pennsylvania Avenue, NW, Washington, DC 20460. Overnight or courier deliveries should be sent to the office location at 1201 Constitution Avenue, NW, Washington, DC 20004.

For more information on the agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the original SNAP rulemaking published in the Federal Register on March 18, 1994 (59 FR 13044). Notices and rulemakings under the SNAP program, as well as other EPA publications on protection of stratospheric ozone, are available at EPA's Ozone Depletion Website at www.epa.gov/ozone/strathome.html including the SNAP portion at www.epa.gov/ozone/snap/.

SUPPLEMENTARY INFORMATION:

- I. Listing of New Acceptable Substitutes
 - A. Refrigeration and Air Conditioning
 - B. Foam Blowing
 - C. Fire Suppression and Explosion Protection
- II. Section 612 Program
 - A. Statutory Requirements and Authority for the SNAP Program
 - B. EPA's Regulations Implementing Section 612

C. How the Regulations for the SNAP Program Work

D. Additional Information about the SNAP Program

Appendix A – Summary of Decisions for New Acceptable Substitutes

I. Listing of New Acceptable Substitutes

This action presents EPA's most recent decision to list as acceptable several substitutes in the refrigeration and air conditioning, foam blowing, and fire suppression and explosion protection sectors. New substitutes include *trans*-1-chloro-3,3,3-trifluoroprop-1-ene in non-mechanical heat transfer, and in flexible polyurethane foams; CO₂ in refrigerated transport; R-450A in a variety of refrigeration and air conditioning end-uses; methylal and hydrofluoroolefin (HFO)-1336mzz(Z) in a variety of foam blowing end-uses; and Powdered Aerosol D in the total flooding end-use. For copies of the full list of acceptable substitutes for ozone depleting substances (ODS) in all industrial sectors, visit EPA's Ozone Layer Protection web site at www.epa.gov/ozone/snap/lists/index.html.

The sections below discuss each substitute listing in detail. Appendix A contains tables summarizing today's listing decisions for these new acceptable substitutes. The statements in the "Further Information" column in the tables provide additional information, but are not legally binding under section 612 of the Clean Air Act (CAA). In addition, the "Further Information" may not be a comprehensive list of other legal obligations you may need to meet when using the substitute. Although you are not required to follow recommendations in the "Further Information" column of the table to use a substitute consistent with section 612 of the CAA, some of these statements may

refer to obligations that are enforceable or binding under federal or state programs other than the SNAP program. In many instances, the information simply refers to standard operating practices in existing industry and/or building-code standards. EPA strongly encourages you to apply the information in this column using these substitutes. Many of these recommendations, if adopted, would not require significant changes to existing operating practices.

You can find submissions to EPA for the substitutes listed in this document, as well as other materials supporting the decisions in this action in docket EPA-HQ-OAR-2003-0118 at www.regulations.gov.

A. Refrigeration and Air Conditioning

1. *Trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E))

EPA's decision: EPA finds trans-1-chloro-3,3,3-trifluoroprop-1-ene acceptable as a substitute for use in new equipment in non-mechanical heat transfer¹.

Trans-1-chloro-3,3,3-trifluoroprop-1-ene ((E)-1-chloro-3,3,3-trifluoroprop-1-ene, CAS Reg. No. 102687-65-0) is a chlorofluoroalkene marketed under the trade names Solstice™ 1233zd(E) and Solstice™ N12 Refrigerant for this end-use.

You may find the redacted submission in Docket item EPA-HQ-OAR-2003-0118-0285 and under the name, “9/17/13 Letter to Rebecca von dem Hagen, EPA re: 1233zd(E) – Refrigeration Sector” in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov. EPA has performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in docket EPA-HQ-

¹ Acceptable substitutes for organic Rankine cycle have typically been included through listings in the non-mechanical heat transfer end-use. EPA may review organic Rankine cycle applications separately in the future.

OAR-2003-0118 under the name, “Risk Screen on Substitutes in Heat Transfer Substitute: *Trans*-1-Chloro-3,3,3-trifluoroprop-1-ene.”

We have previously listed *trans*-1-chloro-3,3,3-trifluoroprop-1-ene as a refrigerant for use in new equipment in centrifugal chillers (August 10, 2012, 77 FR 47768).

Environmental information: Solstice™ 1233zd(E) has an ozone depletion potential (ODP) of 0.00024 to 0.00034.^{2,3} Estimates of this compound’s potential to deplete the ozone layer indicate that even with worst-case estimates of emissions, which assume that this compound would substitute for all compounds it could replace, the impact on global atmospheric ozone abundance would be statistically insignificant.⁴ Solstice™ 1233zd(E) has a 100-year integrated global warming potential (100-yr GWP) reported as 1 to 7 and an atmospheric lifetime of approximately 26 to 31 days or less.^{5,6,7} Solstice™ 1233zd(E) is excluded from the definition of volatile organic compounds (VOC) under CAA regulations (see 40 CFR 51.100(s)) addressing the development of

² Wang D., Olsen S., Wuebbles D. 2011. “Preliminary Report: Analyses of tCFP’s Potential Impact on Atmospheric Ozone.” Department of Atmospheric Sciences. University of Illinois, Urbana, IL. September 26, 2011.

³ Patten and Wuebbles, 2010. “Atmospheric Lifetimes and Ozone Depletion Potentials of *trans*-1-chloro-3,3,3-trichloropropylene and *trans*-1,2-dichloroethylene in a three-dimensional model.” *Atmos. Chem. Phys.*, 10, 10867–10874, 2010.

⁴ Wang et al., 2011. *Op. cit.*

⁵ Sulbaek Andersen, Nilsson, Neilsen, Johnson, Hurley and Wallington, “Atmospheric chemistry of *trans*-CF₃CH=CHCl: Kinetics of the gas-phase reactions with Cl atoms, OH radicals, and O₃”, *Jrnl of Photochemistry and Photobiology A: Chemistry* 199 (2008) 92-97; and Wang D., Olsen S., Wuebbles D. Undated. “Three-Dimensional Model Evaluation of the Global Warming Potentials for tCFP.” Department of Atmospheric Sciences. University of Illinois, Urbana, IL. Draft report, undated.

⁶ Wang et al. 2011 and Sulbaek Andersen et al., 2008. *Op cit.*

⁷ Hodnebrog, Ø., Etmann, M., Fuglestad, J. S., Marston, G., Myhre, G., Nielsen, C. J., Shine, K. P., Wallington, T. J.: Global Warming Potentials and Radiative Efficiencies of Halocarbons and Related Compounds: A Comprehensive Review, *Reviews of Geophysics*, 51, 300-378, doi:10.1002/rog.20013, 2013.

state implementation plans (SIPs) to attain and maintain the National Ambient Air Quality Standards (NAAQS). The emissions of this refrigerant will be limited, given that it is subject to the venting prohibition under section 608(c)(2) of the CAA and EPA's venting regulations codified at 40 CFR 82.154(a)(1).

Flammability information: Solstice™ 1233zd(E) is not flammable.

Toxicity and exposure data: Potential health effects of this substitute include serious eye irritation, skin irritation, and frostbite. It may cause central nervous system effects such as drowsiness and dizziness. The substitute could cause asphyxiation if air is displaced by vapors in a confined space.

The American Industrial Hygiene Association (AIHA) has established a Workplace Environmental Exposure Level (WEEL) of 800 ppm for *trans*-1-chloro-3,3,3,-trifluoroprop-1-ene. EPA anticipates that Solstice™ 1233zd(E) will be used in a manner consistent with the recommendations specified in the manufacturer's material safety data sheet (MSDS). EPA anticipates that users will be able to meet the WEEL and address potential health risks by following requirements and recommendations in the MSDS and in any other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in these end-uses: Solstice™ 1233zd(E) has an ODP of 0.00024 to 0.00034 and estimates of its maximum potential impact on the ozone layer indicate a statistically insignificant impact, comparable to that of other substitutes in the same end-uses that are considered to be non-ozone-depleting.⁸ Solstice™ 1233zd(E)'s

⁸ Wang et al., 2011 and Patten and Wuebbles, 2010. *Op cit.*

ODP is well below those of ODS in these end-uses, such as chlorofluorocarbon (CFC)-113, HCFC-141b, HCFC-22, and HCFC-123 (with ODPs ranging from 0.01 to 0.8⁹). Solstice™ 1233zd(E)'s GWP of 1 to 7 is lower than or comparable to those of other acceptable substitutes in the same end-uses, such as HFC-245fa, HFC-134a and HFC-125 (with GWPs ranging from 1,030 to 3,500¹⁰). Its GWP is also well below those of CFC-113, HCFC-141b, HCFC-22, and HCFC-123 (with GWPs ranging from 77 to 4,750). Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the AIHA WEEL standard, the American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 15 and other industry standards, recommendations in the MSDS, and other safety precautions common in the refrigeration and air conditioning industry. The potential health effects of Solstice™ 1233zd(E) are common to many refrigerants, including many of those already listed as acceptable under SNAP. EPA thus finds *trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E)) acceptable in the end-uses listed above, because the overall environmental and human health risk posed by *trans*-1-chloro-3,3,3-trifluoroprop-1-ene is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-uses.

2. Carbon dioxide (R-744)

⁹ Unless otherwise stated, all ODPs in this document are from EPA's regulations at appendix A to subpart A of 40 CFR part 82.

¹⁰ Unless otherwise stated, all GWPs in this document are from: IPCC, 2007: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. This document is accessible at www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html

EPA's decision: EPA finds carbon dioxide (R-744) acceptable as a substitute for use in new equipment in refrigerated transport.

Carbon dioxide is also known as CO₂, CAS Reg. No. 124-38-9, or R-744 when used as a refrigerant.

You may find the redacted submission in docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, "SNAP Information Notice for CO₂ in Refrigerated Transport received 7/19/13." EPA has performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in docket EPA-HQ-OAR-2003-0118 under the name, "Risk Screen on Substitutes in Refrigerated Transport Substitute: Carbon Dioxide (CO₂)."

We have previously listed CO₂ as a refrigerant in a number of other refrigeration and air conditioning end-uses (e.g., January 13, 1995, 60 FR 3318; September 30, 2009, 74 FR 50129; June 6, 2012, 77 FR 33315; August 10, 2012, 77 FR 47768).

Environmental information: CO₂ has an ODP of zero. The 100-yr GWP of CO₂ is 1.

EPA's regulations codified at 40 CFR part 82, subpart F exempt CO₂ refrigerant from the venting prohibition under section 608(c)(2) of the CAA (see 69 FR 11946; March 12, 2004). This section and EPA's venting regulations prohibit the intentional venting or release of substitutes for class I or class II ODS during the repair, maintenance, service or disposal of refrigeration and air conditioning appliances, unless EPA expressly exempts a particular substitute refrigerant from the venting prohibition, as for CO₂.

CO₂ is excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

Flammability information: CO₂ is not flammable.

Toxicity and exposure data: Potential health effects of this substitute at lower concentrations include loss of concentration, headache and shortness of breath. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, it may cause central nervous system depression. The substitute could cause asphyxiation, if air is displaced by vapors in a confined space. For additional information concerning potential health risks of CO₂, see EPA's final rule under the SNAP program for use of CO₂ as a refrigerant in motor vehicle air conditioning systems (77 FR 33315; June 6, 2012) and EPA's risk screen in docket EPA-HQ-OAR-2003-0118.

To protect against these potential health risks, CO₂ has an 8 hour/day, 40 hour/week permissible exposure limit (PEL) of 5,000 ppm in the workplace required by the Occupational Safety and Health Administration (OSHA). It also has a 15-minute recommended short-term exposure limit (STEL) of 30,000 ppm established by the National Institute for Occupational Safety and Health (NIOSH). EPA recommends that users follow all requirements and recommendations specified in the MSDS, in ASHRAE standard 15, and other safety precautions common in the refrigeration and air conditioning industry. We also recommend that users of CO₂ adhere to NIOSH's STEL and to ASHRAE 15, and we expect that users will meet OSHA's PEL. EPA anticipates that users will be able to address potential health risks by complying with the PEL and by

following requirements and recommendations in the MSDS, in ASHRAE 15, and other safety precautions common in the refrigeration and air conditioning industry.

Comparison to other substitutes in the same end-use: CO₂ is not ozone-depleting, comparable to a number of other acceptable non-ozone-depleting substitutes for these end-uses, including R-404A, R-407C, R-410A, and HFC-134a, and in contrast to the ODS CFC-12, HCFC-22 and R-502 (with ODPs ranging from 0.04 to 1.0). CO₂'s GWP of 1 is lower than or comparable to that of other non-ozone-depleting substitutes in the same refrigeration and air conditioning end-use for which we are finding it acceptable, such as R-404A, R-407C, R-410A and HFC-134a (with GWP's ranging from 1,430 to 3,930). Furthermore, the GWP of CO₂ is well below those of ODS used in this end-use, including CFC-12, HCFC-22 and R-502 (with GWPs ranging from 1,810 to 10,900). Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the OSHA PEL, ASHRAE 15, and other industry standards, recommendations in the MSDS, and other safety precautions common in the refrigeration and air conditioning industry. The potential health effects of CO₂ are common to many refrigerants, including many of those already listed as acceptable under SNAP. EPA thus finds CO₂ acceptable in the end-use listed above, because the overall environment and human health risk posed by CO₂ is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-use.

3. R-450A

EPA's decision: EPA finds R-450A acceptable as a substitute for use in:

- Retail food refrigeration (new and retrofit equipment)

- Refrigerated transport (new and retrofit equipment)
- Vending machines (retrofit equipment only)
- Commercial ice machines (new and retrofit equipment)
- Water coolers (new and retrofit equipment)
- Cold storage warehouses (new and retrofit equipment)
- Industrial process refrigeration (new and retrofit equipment)
- Reciprocating, screw and scroll chillers (new and retrofit equipment)
- Centrifugal chillers (new and retrofit equipment)
- Household refrigerators and freezers (new and retrofit equipment)
- Industrial process air-conditioning (new and retrofit equipment)

R-450A, marketed under the trade name Solstice® N-13, is a weighted blend of 42 percent HFC-134a, which is also known as 1,1,1,2 tetrafluoroethane (CAS Reg. No. 811-97-2) and 58 percent HFO-1234ze(E), which is also known as *trans*-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Solstice N-13 (R-450A) SNAP Information Notice.” EPA has performed assessments to examine the health and environmental risks of this substitute. These assessments are available in docket EPA-HQ-OAR-2003-0118 under the following names:

- “Risk Screen on Substitutes for Use in Retail Food Refrigeration, Vending Machines, and Commercial Ice Machines Substitute: R-450A”

- Risk Screen on Substitutes for Use in Household Refrigerators and Freezers and Water Coolers Substitute: R-450A”
- Risk Screen on Substitutes for Use in Chillers and Industrial Process Air Conditioning Substitute: R-450A”
- Risk Screen on Substitutes for Use in Cold Storage Warehouses and Industrial Process Refrigeration Substitute: R-450A”
- Risk Screen on Substitutes for Use in Refrigerated Transport Substitute: R-450A”

Environmental information: R-450A has an ODP of zero. Its components, HFC-134a and HFO-1234ze(E), have GWPs of 1,430 and 1 to 6¹¹, respectively. If these values are weighted by mass percentage, then R-450A has a GWP of about 601. The components of R-450A are both excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. The emissions of this refrigerant blend will be limited given it is subject to the venting prohibition under section 608(c)(2) of the CAA and EPA’s venting regulations codified at 40 CFR 82.154(a)(1),¹² which limit emissions of refrigerant substitutes.

Flammability information: R-450A as formulated and in the worst-case fractionation formulation is not flammable.

¹¹ Hodnebrog, Ø., et.al, 2013, *op cit.*; Atmospheric chemistry of trans-CF₃CH=CHF: products and mechanisms of hydroxyl radical and chlorine atom initiated oxidation”, M. S. Javadi, R. Søndergaard, O.J. Nielsen, M. D. Hurley, and T.J. Wellington, *Atmospheric Chemistry and Physics Discussions* 8, 1069-1088, 2008

¹² For more information, including definitions, see 40 CFR part 82, subpart F.

Toxicity and exposure data: Potential health effects of this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

The AIHA has established WEELs of 1,000 ppm and 800 ppm as an 8-hour time-weighted averages (TWAs) for HFC-134a and HFO-1234ze(E), the components of R-450A. EPA anticipates that users will be able to meet either of the AIHA WEELs and address potential health risks by following requirements and recommendations in the MSDS, in ASHRAE 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in these end-uses: R-450A has an ODP of zero, in contrast to the ODS HCFC-22, HCFC-142b, and HCFC-123 (with ODPs ranging from 0.01 to 0.6), and comparable to a number of other acceptable non-ozone-depleting substitutes in these end-uses, such as HFC-134a and R-404A. R-450A's GWP of about 601 within the range of HCFC-22, HCFC-142b, and HCFC-123 (with GWPs ranging from 77 to 2,310), and lower than that of other non-ozone-depleting substitutes in the same refrigeration and air conditioning end-uses, such as HFC-134a and R-404A (with GWPs of 1,430 and 3,930). Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15 and other industry standards, recommendations in the MSDS, and other safety precautions common in the refrigeration and air conditioning industry. The potential health effects of R-450A

are common to many refrigerants, including many of those already listed as acceptable under SNAP. EPA thus finds R-450A acceptable in the end-uses listed above, because the overall environmental and human health risk posed by R-450A is lower than the risks posed by other substitutes found acceptable in the same end-uses.

B. Foam Blowing

1. *Trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E))

EPA's decision: EPA finds trans-1-chloro-3,3,3-trifluoroprop-1-ene acceptable as a substitute for use as a blowing agent in flexible polyurethane foams.

Trans-1-chloro-3,3,3-trifluoroprop-1-ene ((E)-1-chloro-3,3,3-trifluoroprop-1-ene, CAS Reg. No. 102687-65-0) is a chlorofluoroalkene marketed under the trade name Solstice™ 1233zd(E) for various foam blowing end-uses.

You may find the redacted submission in docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name “TSCA/SNAP Addendum for *trans*-1-chloro-3,3,3-trifluoroprop-1-ene in flexible foams.” EPA has performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in docket EPA-HQ-OAR-2003-0118 under the name “Risk Screen on Substitutes for Use in Flexible Polyurethane Foams Substitute: *Trans*-1-chloro-3,3,3-trifluoroprop-1-ene”.

We have previously listed *trans*-1-chloro-3,3,3-trifluoroprop-1-ene as a foam blowing agent in a number of end-uses (August 10, 2012, 77 FR 47768).

Environmental information: The environmental information for this substitute is set forth in the ‘Environmental information’ section in listing A.1.

Flammability information: Solstice™ 1233zd(E) is not flammable.

Toxicity and exposure data: The toxicity information for this substitute is set forth in the “Toxicity and exposure data” section in listing A.1.

The AIHA has established a WEEL of 800 ppm for *trans*-1-chloro-3,3,3-trifluoroprop-1-ene. EPA anticipates that Solstice™ 1233zd(E) will be used in a manner consistent with the recommendations specified in the manufacturer's MSDS. EPA anticipates that users will be able to meet the WEEL and address potential health risks by following requirements and recommendations in the MSDS and in any other safety precautions common to the foam blowing industry.

Comparison to other substitutes in this end-use: Solstice™ 1233zd(E) has an ODP of 0.00024 to 0.00034 and estimates of its maximum potential impact on the ozone layer indicate a statistically insignificant impact, comparable to that of other substitutes in the same end-uses that are considered to be non-ozone-depleting.¹³ Solstice™ 1233zd(E)'s ODP is well below that of the ODS CFC-11 and HCFC-141b (with ODPs ranging from 0.11 to 1.0). Solstice™ 1233zd(E)'s GWP of 1 to 7 is lower than or comparable to that of other acceptable substitutes in the same end use, such as HFC-134a, HFC-245fa and HFC-152a (with GWPs ranging from 124 to 1,430) and C3-C6 saturated light hydrocarbons¹⁴ (with GWPs less than 10). Its GWP is also well below those of CFC-11 and HCFC-141b (with GWPs ranging from 725 to 4,750). Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the AIHA WEEL, recommendations in the MSDS, and other safety precautions common in the foam blowing industry. The potential health effects of Solstice™ 1233zd(E) are

¹³ Wang et al., 2011 and Patten and Wuebbles, 2010. *Op cit.*

¹⁴ That is, unsaturated hydrocarbons with 3 to 6 carbons, such as propane, butane, pentane, isopentane, and cyclopentane.

common to many foam blowing agents, including many of those already listed as acceptable under SNAP. EPA thus finds *trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E)) acceptable in the end-use listed above, because the overall environmental and human health risk posed by *trans*-1-chloro-3,3,3-trifluoroprop-1-ene is lower than or comparable to the risks posed by other substitutes found acceptable in the same end-use.

2. Methylal (Dimethoxymethane)

EPA's decision: EPA finds methylal acceptable as a substitute for use as a blowing agent in:

- Rigid polyurethane and polyisocyanurate laminated boardstock
- Rigid polyurethane appliance
- Rigid polyurethane commercial refrigeration and sandwich panels
- Rigid polyurethane slabstock and other
- Flexible polyurethane
- Integral skin polyurethane

Methylal is also called dimethoxymethane, CAS 109-87-5. It belongs to a class of chemicals referred to as acetals.

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name “SNAP Information Notice for methylal received 4/18/14.” EPA has performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in docket EPA-HQ-OAR-2003-0118 under the name “Risk Screen on Substitutes for Use in Rigid Polyurethane Appliance Foam; Commercial and Sandwich Panels; Rigid Polyurethane & Polyisocyanurate

Laminate Boardstock; Rigid Polyurethane Slabstock; Flexible Polyurethane; Integral Skin Polyurethane Substitute: Methylal (Dimethoxymethane)”. EPA’s review of this substitute is pending for spray foam.

Environmental information: Methylal has an ODP of zero. The 100-yr GWP of methylal is less than three. Methylal is a VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

Flammability information: Methylal is flammable. Under the Globally Harmonized System of Classification and Labelling of Chemicals, it is classified as a Class II flammable liquid and under OSHA’s regulations at 29 CFR 1910.106, it is classified as a Class IB flammable liquid. Some specific blends of methylal with other blowing agents are flammable as formulated and should be handled with proper precautions, as specified by the manufacturer.¹⁵ EPA recommends that users follow all requirements and recommendations specified in the MSDS and other safety precautions for use of flammable blowing agents used in the foam blowing industry. Use of methylal will require safe handling and shipping as prescribed by OSHA and the Department of Transportation (for example, using personal protective equipment and following requirements for shipping hazardous materials at 49 CFR parts 170 through 173).

¹⁵59 FR at 13084. “The Agency has determined that because of the potential for formation and emission of decomposition products in rigid closed cell foams, notification and review under SNAP is required for blends of chemical alternatives in foam end-uses that encompass residential products where chronic consumer exposure could occur. These end-uses are: polyurethane rigid laminated boardstock, polystyrene extruded boardstock and billet foams, phenolic foams, and polyolefin foams.”

Toxicity and exposure data: Potential health effects of this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space.

EPA anticipates that methylal will be used consistent with the recommendations specified in the manufacturer's MSDS. The American Conference of Governmental Industrial Hygienists (ACGIH) has established a threshold limit value (TLV) of 1,000 ppm (8-hr TWA) for methylal. NIOSH has a recommended exposure limit (REL) of 1,000 ppm for methylal on a 10-hour time-weighted average. EPA anticipates that users will be able to meet workplace exposure limits (TLV and REL) and address potential health risks by following requirements and recommendations in the MSDS and in other safety precautions common to the foam blowing industry.

Comparison to other substitutes in the same end uses: Methylal has an ODP of zero, comparable to a number of other acceptable non-ozone-depleting substitutes for these end uses, such as HFC-134a, HFC-245fa, HFC-152a, and C3-C6 saturated light hydrocarbons, and in contrast to the ODS CFC-11, HCFC-141b, HCFC-142b and HCFC-22 (with ODPs ranging from 0.04 to 1.0). Methylal's GWP of less than three is lower than or comparable to that of other non-ozone-depleting substitutes in the same foam blowing end uses for which we are finding it acceptable, such as HFC-134a, HFC-245fa and HFC-152a (with GWPs ranging from 124 to 1,430) and C3-C6 saturated light hydrocarbons (with GWPs less than 10). Furthermore, the GWP of methylal is lower than those of CFC-11, HCFC-141b, HCFC-142b and HCFC-22 (with GWPs ranging from 725

to 4,750). Like other flammable substitutes in these end uses, such as HFC-365mfc or C3-C6 saturated light hydrocarbons, flammability risks can be addressed by following the MSDS and other procedures common in the foam blowing industry in the end uses listed. Toxicity risks can be minimized by use consistent with the ACGIH TLV and NIOSH REL, recommendations in the MSDS, and other safety precautions common in the foam blowing industry. The potential health effects of methylal are common to many foam blowing agents, including many of those already listed as acceptable under SNAP. The EPA thus finds methylal acceptable in the end uses listed above, because the overall environmental and human health risk posed by methylal is lower than or comparable to the risks posed by other substitutes found acceptable in the same end uses.

3. HFO-1336mzz(Z) (Formacel® 1100)

EPA's decision: EPA finds HFO-1336mzz(Z) acceptable as a substitute for use as a blowing agent in:

- Rigid polyurethane appliance foam
- Rigid polyurethane commercial refrigeration and sandwich panels
- Flexible polyurethane
- Integral skin polyurethane
- Rigid polyurethane slabstock and other
- Rigid polyurethane and polyisocyanurate laminated boardstock
- Phenolic insulation board and bunstock

HFO-1336mzz(Z) is a hydrofluoroolefin or unsaturated hydrofluorocarbon. It is also called (Z)-1,1,1,4,4,4-hexafluorobut-2-ene or *cis*-1,1,1,4,4,4-hexafluorobut-2-ene

(CAS Reg. No. 692-49-9) and also goes by the trade names of FEA-1100 or Formacel® 1100.

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “SNAP Information Notice for FEA-1100 as a Foam Blowing Agent Received 8/3/11.” EPA has performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in docket EPA-HQ-OAR-2003-0118 under the name “Risk Screen on Substitutes for Use in Rigid Polyurethane Appliance Foam; Rigid Polyurethane and Polyisocyanurate Laminated Boardstock; Rigid Polyurethane Commercial Refrigeration and Sandwich Panels; Rigid Polyurethane Slabstock and Other; Flexible Polyurethane; Integral Skin Polyurethane; and Phenolic Insulation Board and Bunstock: HFO-1336mzz(Z) (Formacel® 1100).” EPA’s review of this substitute is pending for spray foam.

Environmental information: HFO-1336mzz(Z) has an ODP of zero. It has a 100-yr GWP of about 9.¹⁶ HFO-1336mzz(Z) is a VOC. The manufacturer has petitioned the EPA to exempt HFO-1336mzz(Z) from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS based on its claim that the chemical exhibits low photochemical reactivity.

Flammability information: HFO-1336mzz(Z) is not flammable.

Toxicity and exposure data: Potential health effects of this substitute include skin or eye irritation or frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors

¹⁶Atmospheric Chemistry of (Z)-CF₃CH=CHCF₃: OH Radical Reaction Rate Coefficient and Global Warming Potential; Munkhbayar Baasandorj, A.R. Ravishankara, and James B. Burkholder. *J. Phys. Chem. A*, 2011, 115 (38), pp. 10539–10549.

in a confined space. These potential health effects are common to many foam blowing agents. The EPA anticipates that HFO-1336mzz(Z) will be used consistent with the recommendations specified in the MSDS. The manufacturer recommends an acceptable exposure limit (AEL) for the workplace of 500 ppm on an 8-hour TWA¹⁷. The EPA anticipates that users will be able to meet the manufacturer's AEL and address potential health risks by following requirements and recommendations in the MSDS and other safety precautions common to the foam blowing industry.

Comparison to other foam blowing agents: HFO-1336mzz(Z) has an ODP of zero, comparable to a number of other acceptable non-ozone-depleting substitutes for these end uses such as HFC-134a, HFC-245fa, HFC-152a, and C3-C6 saturated light hydrocarbons and in contrast to CFC-11, CFC-113, HCFC-141b, and HCFC-22 (with ODPs ranging from 0.04 to 1.0). HFO-1336mzz(Z)'s GWP of about 9 is lower than or comparable to those of other acceptable substitutes in the same end uses for which we are finding it acceptable, such as HFC-134a, HFC-245fa, and HFC-152a (with GWPs ranging from 124 to 1,430), C3-C6 saturated light hydrocarbons (with GWPs less than 10), and Solstice-1233zd(E) with a GWP of 1 to 7 (see listing B.1 above and 77 FR 47772). Further, the GWP of HFO-1336mzz(Z) is less than those of CFC-11, CFC-113, HCFC-141b, and HCFC-22, with GWPs ranging from 725 to 4,750. Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the manufacturer's recommended AEL, recommendations in the MSDS, and other safety

¹⁷ As of the time of signature of this document, the WEEL Committee of the Occupational Alliance for Risk Science had proposed, but not yet finalized, a WEEL of 500 ppm for HFO-1336mzz(Z). The proposed documentation may be viewed at www.tera.org/OARS/HFO-1336mzz-Z%20public%20comments%209-18-14.pdf.

precautions common in the foam blowing industry. The potential health effects of HFO-1336mzz(Z) are common to many foam blowing agents, including many of those already listed as acceptable under SNAP. EPA thus finds HFO-1336mzz(Z) acceptable in the end uses listed above, because the overall environmental and human health risk posed by HFO-1336mzz(Z) is lower than or comparable to the risks posed by other substitutes found acceptable in the same end uses.

C. Fire Suppression and Explosion Protection

1. Powdered Aerosol D (Aero-K[®], Stat-X[®])

EPA's decision: EPA finds Powdered Aerosol D acceptable as a substitute for total flooding uses.

Powdered Aerosol D is a pyrotechnic particulate aerosol and explosion suppressant that also is marketed under the trade names of Aero-K[®] and Stat-X[®]. This fire suppressant is supplied to users as a solid housed in a double-walled hermetically-sealed steel container. When the unit is triggered by heat (300°C), the product is pyrotechnically activated to produce gases and aerosol particles from a mixture of chemicals. EPA previously listed Powdered Aerosol D as acceptable subject to use conditions (71 FR 56359; September 7, 2006). The use conditions require that Powdered Aerosol D be used only in areas that are not normally occupied, on the basis of information supporting its safe use in areas that are not normally occupied. Based on a review of additional information from the submitter to support the safe use of Powdered Aerosol D in normally occupied spaces, EPA now determines that Powdered Aerosol D is also acceptable for use in total flooding systems for normally occupied spaces. The listing will

provide that Powdered Aerosol D is acceptable for total flooding uses, which would include both unoccupied and occupied spaces. In a subsequent rulemaking EPA will remove the previous listing as acceptable subject to use conditions. In the "Further Information" column of the tables summarizing today's listing decisions and found at the end of this document, we also state that use of this agent should continue to be in accordance with the safety guidelines in the latest edition of the National Fire Protection Association (NFPA) 2010 Standard for Aerosol Extinguishing Systems.

You may find the redacted submission in Docket item EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, "8/8/13 letter from Marc Gross, Fireaway to Rebecca von dem Hagen, EPA and SNAP Information Notice for Stat-X." EPA has performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in docket EPA-HQ-OAR-2003-0118 under the name, "Risk Screen on Substitutes for Total Flooding Systems in Normally Occupied Spaces-Substitute: Powdered Aerosol D (Stat-X[®])."

Environmental information: The active ingredients of Powdered Aerosol D are solids both before and after use; thus, their ODP and GWP are both zero. The gaseous post-activation products for Powdered Aerosol D also have zero ODP and GWPs of 25 or less. The solid active ingredients and particulate post-activation products do not participate in atmospheric photochemical reactions and are not VOCs. The gaseous post-activation products are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

None of the pre- or post-activation constituents of Powdered Aerosol D will exist in quantities approaching the respective reporting quantities under the Clean Water Act for priority or toxic pollutants. During post-activation clean-up procedures, clean-up residues should be disposed of in accordance with requirements appropriate for those materials, as outlined in the agent's MSDS and local, state, and federal regulations.

Flammability information: Powdered Aerosol D's post-activation products are nonflammable.

Toxicity and exposure data: Exposure to Powdered Aerosol D after activation may cause temporary, mild irritation of the mucous membrane. If eye or skin contact occurs, end users should flush eyes with water or wash skin with soap and water. Exposure to the post-discharge products is expected to be below the relevant workplace exposure limits for those compounds. Because it is housed in a hermetically sealed container, exposure should not occur unless the system is activated.

Information on additional safety recommendations: The discharge of the aerosol results in a reduction of visibility in the protected space due to the uniform distribution of the particulate generated. Use according to the NFPA 2010 Standard will further reduce any safety risks due to reduced visibility. In addition, EPA recommends that cross-zone detection systems and abort switches located near an exit from the protected space be employed.

In the "Further Information" column of the tables summarizing today's listing decisions, EPA recommends the following for establishments manufacturing Powdered Aerosol D and filling containers to be used in total flooding applications:

- Workers should use appropriate safety and protective equipment (e.g., protective gloves, tightly sealed goggles, protective work clothing, and particulate-removing respirators using NIOSH type N95 or better filters) consistent with OSHA guidelines.
- A local exhaust system should be installed and operated to provide adequate ventilation to reduce airborne exposure to Powdered Aerosol D constituents.
- An eye wash fountain and quick drench facility should be close to the production area.
- Training for safe handling procedures should be provided to all employees that would be likely to handle the containers of the agent or extinguishing units filled with the agent.
- Workers responsible for cleanup should allow particulates to settle before reentering area and wear appropriate personal protective equipment.
- All spills should be cleaned up immediately in accordance with good industrial hygiene practices.

EPA expects that procedures identified in the MSDS for Powdered Aerosol D and good manufacturing practices will be adhered to, and that the appropriate safety and personal protective equipment (PPE) consistent with OSHA guidelines will be used during installation, servicing, post-discharge clean-up and disposal of total flooding systems using Powdered Aerosol D. The manufacturer should provide guidance upon installation of the system regarding the appropriate time after which workers may re-enter the area for disposal to allow the maximum settling of all particulates.

Comparison to other substitutes in this end use: Powdered Aerosol D has zero ODP, both prior to and after activation. In comparison, Halon 1301 has an ODP of 12 and other acceptable substitutes used in this end use, such as HCFC Blend A, HFC-227ea, and HFC-125 have ODPs of 0.048, zero and zero. The active ingredients of Powdered Aerosol D have a GWP of zero prior to activation and the gaseous post-activation products have a GWP of 25 or less. In comparison, Halon 1301 has a GWP of 7,140 and other acceptable substitutes used in this end use, such as HCFC Blend A, HFC-227ea, and HFC-125 have GWPs of about 1,550, 3,220, and 3,500, respectively. Toxicity risks can be minimized by use consistent with the NFPA 2010 standard, recommendations in the MSDS, and other safety precautions common in the fire suppression industry. The potential health effects of Powdered Aerosol D are common to many fire suppressants, including many of those already listed as acceptable under SNAP. EPA thus finds Powdered Aerosol D acceptable in the total flooding end-use because it does not pose a greater overall risk to human health and the environment than other acceptable substitutes in this end-use.

II. Section 612 Program

A. Statutory Requirements and Authority for the SNAP Program

Section 612 of the CAA requires EPA to develop a program for evaluating alternatives to ozone-depleting substances. EPA refers to this program as the Significant New Alternatives Policy (SNAP) program. The major provisions of section 612 are:

1. Rulemaking

Section 612(c) requires EPA to promulgate rules making it unlawful to replace

any class I substance (e.g., chlorofluorocarbon, halon, carbon tetrachloride, methyl chloroform, and hydrobromofluorocarbon) or class II substance (e.g., hydrochlorofluorocarbon) with any substitute that the Administrator determines may present adverse effects to human health or the environment where the Administrator has identified an alternative that (1) reduces the overall risk to human health and the environment, and (2) is currently or potentially available.

2. Listing of Unacceptable/Acceptable Substitutes

Section 612(c) requires EPA to publish a list of the substitutes unacceptable for specific uses and to publish a corresponding list of acceptable alternatives for specific uses. The list of “acceptable” substitutes is found at www.epa.gov/ozone/snap/lists and the lists of “unacceptable,” “acceptable subject to use conditions,” and “acceptable subject to narrowed use limits” substitutes are found in the appendices to 40 CFR part 82, subpart G.

3. Petition Process

Section 612(d) grants the right to any person to petition EPA to add a substance to, or delete a substance from, the lists published in accordance with section 612(c). The agency has 90 days to grant or deny a petition. Where the agency grants the petition, the EPA must publish the revised lists within an additional six months.

4. 90-day Notification

Section 612(e) directs EPA to require any person who produces a chemical substitute for a class I substance to notify the agency not less than 90 days before new or existing chemicals are introduced into interstate commerce for significant new uses as

substitutes for a class I substance. The producer must also provide the agency with the producer's unpublished health and safety studies on such substitutes.

5. Outreach

Section 612(b)(1) states that the Administrator shall seek to maximize the use of federal research facilities and resources to assist users of class I and II substances in identifying and developing alternatives to the use of such substances in key commercial applications.

6. Clearinghouse

Section 612(b)(4) requires the agency to set up a public clearinghouse of alternative chemicals, product substitutes, and alternative manufacturing processes that are available for products and manufacturing processes which use class I and II substances.

B. EPA's Regulations Implementing Section 612

On March 18, 1994, EPA published the original rulemaking (59 FR 13044) which established the process for administering the SNAP program and issued EPA's first lists identifying acceptable and unacceptable substitutes in the major industrial use sectors (subpart G of 40 CFR part 82). These sectors are the following: refrigeration and air conditioning; foam blowing; solvents cleaning; fire suppression and explosion protection; sterilants; aerosols; adhesives, coatings and inks; and tobacco expansion. These sectors comprise the principal industrial sectors that historically consumed the largest volumes of ODS.

Section 612 of the CAA requires EPA to list as acceptable those substitutes that

do not present a significantly greater risk to human health and the environment as compared with other substitutes that are currently or potentially available.

C. How the Regulations for the SNAP Program Work

Under the SNAP regulations, anyone who plans to market or produce a substitute to replace a class I substance or class II substance in one of the eight major industrial use sectors must provide the Agency with notice and the required health and safety information on the substitute at least 90 days before introducing it into interstate commerce for significant new use as an alternative. 40 CFR 82.176(a). While this requirement typically applies to chemical manufacturers as the person likely to be planning to introduce the substitute into interstate commerce,¹⁸ it may also apply to importers, formulators, equipment manufacturers, and end-users¹⁹ when they are responsible for introducing a substitute into commerce. The 90-day SNAP review process begins once EPA receives the submission and determines that the submission includes complete and adequate data. 40 CFR 82.180(a). The CAA and the SNAP regulations, 40 CFR 82.174(a), prohibit use of a substitute earlier than 90 days after notice has been provided to the Agency.

The agency has identified four possible decision categories for substitute submissions: acceptable; acceptable subject to use conditions; acceptable subject to

¹⁸ As defined at 40 CFR 82.104, “interstate commerce” means the distribution or transportation of any product between one state, territory, possession or the District of Columbia, and another state, territory, possession or the District of Columbia, or the sale, use or manufacture of any product in more than one state, territory, possession or District of Columbia. The entry points for which a product is introduced into interstate commerce are the release of a product from the facility in which the product was manufactured, the entry into a warehouse from which the domestic manufacturer releases the product for sale or distribution, and at the site of United States Customs clearance.

¹⁹ As defined at 40 CFR 82.172, “end-use” means processes or classes of specific applications within major industrial sectors where a substitute is used to replace an ODS.

narrowed use limits; and unacceptable.²⁰ 40 CFR 82.180(b). Use conditions and narrowed use limits are both considered “use restrictions” and are explained below. Substitutes that are deemed acceptable without use conditions may be used for all applications within the relevant end-uses within the sector and without limits under SNAP on how they may be used. Substitutes that are acceptable subject to use restrictions may be used only in accordance with those restrictions. Substitutes that are found to be unacceptable may not be used after the date specified in the rulemaking adding such substitute to the list of unacceptable substitutes.²¹

After reviewing a substitute, the agency may make a determination that a substitute is acceptable only if certain conditions in the way that the substitute is used are met to minimize risks to human health and the environment. EPA describes such substitutes as "acceptable subject to use conditions." Entities that use these substitutes without meeting the associated use conditions are in violation of EPA’s SNAP regulations. 40 CFR 82.174(c).

For some substitutes, the Agency may permit a narrowed range of use within an end-use or sector. For example, the Agency may limit the use of a substitute to certain end-uses or specific applications within an industry sector. The Agency requires a user of a narrowed use substitute to demonstrate that no other acceptable substitutes are available

²⁰ The SNAP regulations also include “pending,” referring to submissions for which the EPA has not reached a determination, under this provision.

²¹ As defined at 40 CFR 82.172, “use” means any use of a substitute for a Class I or Class II ozone-depleting compound, including but not limited to use in a manufacturing process or product, in consumption by the end-user, or in intermediate uses, such as formulation or packaging for other subsequent uses. This definition of use encompasses manufacturing process of products both for domestic use and for export. Substitutes manufactured within the United States exclusively for export are subject to SNAP requirements since the definition of use in the rule includes use in the manufacturing process, which occurs within the United States.

for their specific application. The EPA describes these substitutes as “acceptable subject to narrowed use limits.” A person using a substitute that is acceptable subject to narrowed use limits in applications and end-uses that are not consistent with the narrowed use limit is using the substitute in violation of section 612 of the CAA and EPA’s SNAP regulations. 40 CFR 82.174(c).

The section 612 mandate for EPA to prohibit the use of a substitute that may present risk to human health or the environment where a lower risk alternative is available or potentially available²² provides EPA with the authority to change the listing status of a particular substitute if such a change is justified by new information or changed circumstance.

As described in this document and elsewhere, including the original SNAP rulemaking published in the Federal Register at 59 FR 13044 on March 18, 1994, the SNAP program evaluates substitutes within a comparative risk framework. The SNAP program compares new substitutes both to the ozone-depleting substances being phased out under the *Montreal Protocol on Substances that Deplete the Ozone Layer* and the CAA and to other available or potentially available alternatives for the same end uses. The environmental and health risk factors that the SNAP program considers include ozone depletion potential, flammability, toxicity, occupational and consumer health and safety, as well as contributions to global warming and other environmental factors.

²² In addition to acceptable commercially available substitutes, the SNAP program may consider potentially available substitutes. The SNAP program’s definition of “potentially available” is “any alternative for which adequate health, safety, and environmental data, as required for the SNAP notification process, exist to make a determination of acceptability, and which the agency reasonably believes to be technically feasible, even if not all testing has yet been completed and the alternative is not yet produced or sold.” (40 CFR 82.172)

Environmental and human health exposures can vary significantly depending on the particular application of a substitute – and over time, information applicable to a substitute can change. This approach does not imply fundamental tradeoffs with respect to different types of risk, either to the environment or to human health. EPA recognizes that during the two-decade long history of the SNAP program, new alternatives and new information about alternatives have emerged. To the extent possible, EPA considers new information and improved understanding of the risk factors for the environment and human health in the context of the available or potentially available alternatives for a given use.

The agency publishes its SNAP program decisions in the Federal Register. EPA uses notice-and-comment rulemaking to place any alternative on the list of prohibited substitutes, to list a substitute as acceptable only subject to use conditions or narrowed use limits, or to remove a substitute from either the list of prohibited or acceptable substitutes.

In contrast, EPA publishes “notices of acceptability” or “determinations of acceptability,” to notify the public of substitutes that are deemed acceptable with no restrictions. As described in the preamble to the rule initially implementing the SNAP program (59 FR 13044; March 18, 1994), EPA does not believe that rulemaking procedures are necessary to list alternatives that are acceptable without restrictions because such listings neither impose any sanction nor prevent anyone from using a substitute.

Many SNAP listings include “comments” or “further information” to provide additional information on substitutes. Since this additional information is not part of the regulatory decision, these statements are not binding for use of the substitute under the SNAP program. However, regulatory requirements so listed are binding under other regulatory programs (e.g., worker protection regulations promulgated by OSHA). The “further information” classification does not necessarily include all other legal obligations pertaining to the use of the substitute. While the items listed are not legally binding under the SNAP program, EPA encourages users of substitutes to apply all statements in the “further information” column in their use of these substitutes. In many instances, the information simply refers to sound operating practices that have already been identified in existing industry and/or building codes or standards. Thus many of the statements, if adopted, would not require the affected user to make significant changes in existing operating practices.

D. Additional Information about the SNAP Program

For copies of the comprehensive SNAP lists of substitutes or additional information on SNAP, refer to the EPA’s Ozone Depletion website at: www.epa.gov/ozone/snap. For more information on the agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the SNAP final rulemaking published March 18, 1994 (59 FR 13044), codified at 40 CFR part 82, subpart G. A complete chronology of SNAP decisions and the appropriate citations are found at: www.epa.gov/ozone/snap/chron.html.

List of Subjects in 40 CFR Part 82

Environmental protection, Administrative practice and procedure, Air pollution control, Reporting and recordkeeping requirements.

Date: October 15, 2014

Sarah Dunham, Director
Office of Atmospheric Programs

APPENDIX A: SUMMARY OF ACCEPTABLE DECISIONS

Refrigeration and Air Conditioning

End-Use	Substitute	Decision	Further Information ¹
Centrifugal chillers (<i>retrofit and new</i>).	R-450A (Solstice ® N-13)	Acceptable	<p>R-450A has a 100-year global warming potential (GWP) of approximately 604. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2), and HFO-1234ze(E), which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The American Industrial Hygiene Association (AIHA) has established workplace environmental exposure limits (WEELs) of 1,000 ppm and 800 ppm (8-hr TWA) for HFC-134a and HFO-1234ze(E).</p>
Reciprocating, screw and scroll chillers (<i>retrofit and new</i>).	R-450A (Solstice ® N-13)	Acceptable	<p>R-450A has a 100-year GWP of approximately 604. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2) and HFO-1234ze(E) which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 800 ppm (8-hr TWA) for HFC-134a and HFO-1234ze(E).</p>

End-Use	Substitute	Decision	Further Information ¹
Industrial process refrigeration (<i>retrofit and new</i>).	R-450A (Solstice ® N-13)	Acceptable	<p>R-450A has a 100-year GWP of approximately 604. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2) and HFO-1234ze(E) which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 800 ppm (8-hr TWA) for HFC-134a and HFO-1234ze(E).</p>
Industrial process air conditioning (<i>retrofit and new</i>).	R-450A (Solstice ® N-13)	Acceptable	<p>R-450A has a 100-year GWP of approximately 604. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2) and HFO-1234ze(E) which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 800 ppm (8-hr TWA) for HFC-134a and HFO-1234ze(E).</p>
Cold storage warehouses (<i>retrofit and new</i>).	R-450A (Solstice ® N-13)	Acceptable	<p>R-450A has a 100-year GWP of approximately 604. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2) and HFO-1234ze(E) which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 800 ppm (8-hr TWA) for HFC-134a and HFO-1234ze(E).</p>

End-Use	Substitute	Decision	Further Information ¹
Refrigerated transport (<i>new only</i>).	Carbon dioxide (CO ₂ or R-744)	Acceptable	<p>The Occupational Safety and Health Administration (OSHA) has established a required 8 hour/day, 40 hour/week permissible exposure limit (PEL) for CO₂ of 5,000 ppm. The National Institute for Occupational Safety and Health (NIOSH) has established a 15-minute recommended short-term exposure limit (STEL) of 30,000 ppm.</p> <p>CO₂ is nonflammable.</p> <p>EPA recommends that users follow all requirements and recommendations specified in American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standard 15.</p>
Refrigerated transport (<i>retrofit and new</i>).	R-450A (Solstice ® N-13)	Acceptable	<p>R-450A has a 100-year GWP of approximately 604. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2) and HFO-1234ze(E) which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 800 ppm (8-hr TWA) for HFC-134a and HFO-1234ze(E).</p>

End-Use	Substitute	Decision	Further Information ¹
Retail food refrigeration (<i>retrofit and new</i>).	R-450A (Solstice ® N-13)	Acceptable	<p>R-450A has a 100-year GWP of approximately 604. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2) and HFO-1234ze(E) which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 800 ppm (8-hr TWA) for HFC-134a and HFO-1234ze(E).</p> <p>This decision applies to all types of equipment in this sector, including remote systems, condensing units, and stand-alone equipment.</p>
Vending machines (<i>retrofit only</i>).	R-450A (Solstice ® N-13)	Acceptable	<p>R-450A has a 100-year GWP of approximately 604. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2) and HFO-1234ze(E) which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 800 ppm (8-hr TWA) for HFC-134a and HFO-1234ze(E).</p>
Commercial ice machines (<i>retrofit and new</i>).	R-450A (Solstice ® N-13)	Acceptable	<p>R-450A has a 100-year GWP of approximately 604. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2) and HFO-1234ze(E) which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 800 ppm (8-hr TWA) for HFC-134a and HFO-1234ze(E).</p>

End-Use	Substitute	Decision	Further Information ¹
Water coolers (<i>retrofit and new</i>).	R-450A (Solstice ® N-13)	Acceptable	<p>R-450A has a 100-year GWP of approximately 604. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2) and HFO-1234ze(E) which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm and 800 ppm (8-hr TWA) for HFC-134a and HFO-1234ze(E).</p>
Household refrigerators and freezers (<i>retrofit and new</i>).	R-450A (Solstice ® N-13)	Acceptable	<p>R-450A has a 100-year GWP of approximately 604. This substitute is a blend of HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2) and HFO-1234ze(E) which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>This blend is nonflammable.</p> <p>The AIHA has established a WEELs of 1,000 ppm and 800 ppm (8-hr TWA) for HFC-134a and HFO-1234ze(E).</p>
Non-mechanical heat transfer (<i>new only</i>).	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E))	Acceptable	<p><i>Trans</i>-1-chloro-3,3,3-trifluoroprop-1-ene (CAS Reg. No. 102687-65-0) has an ODP of approximately 0.00024 to 0.00034. It has a 100-year GWP of 1 to 7.</p> <p>This compound is nonflammable.</p> <p>The AIHA has established a WEEL of 800 ppm (8-hr TWA) for <i>trans</i>-1-chloro-3,3,3-trifluoroprop-1-ene.</p>

¹ Observe recommendations in the manufacturer's MSDS and guidance for all listed refrigerants.

Foam Blowing Agents

End-use	Substitute	Decision	Further Information ¹
Rigid polyurethane and polyisocyanurate laminated boardstock	Methylal (dimethoxymethane)	Acceptable	<p>Methylal (CAS Reg. No. 109-87-5) has a 100-yr global warming potential (GWP) of less than three. This substitute is flammable and meets the definition of a flammable Class IB fluid under the Occupational Safety and Health Administration's (OSHA's) regulations at 29 CFR 1910.106.</p> <p>The American Conference of Governmental Industrial Hygienists (ACGIH) has established a Threshold Limit Value (TLV) of 1,000 ppm (8-hr time-weighted average (TWA)) for methylal (dimethoxymethane).</p>
	HFO-1336mzz(Z) ((Z)-1,1,1,4,4,4-hexafluorobut-2-ene, Formacel® 1100)	Acceptable	<p>HFO-1336mzz(Z) (CAS Reg. No. 692-49-9) has no ozone depletion potential (ODP) and a 100-year GWP of roughly 9.</p> <p>This compound is nonflammable.</p> <p>The manufacturer recommends an acceptable exposure limit of 500 ppm over an 8-hour TWA for HFO-1336mzz(Z).</p>
Rigid polyurethane appliance	Methylal (dimethoxymethane)	Acceptable	<p>Methylal (CAS Reg. No. 109-87-5) has a 100-yr GWP of less than three. This substitute is flammable and meets the definition of a flammable Class IB fluid under OSHA's regulations at 29 CFR 1910.106.</p> <p>The ACGIH has established a TLV of 1,000 ppm (8-hr TWA) for methylal (dimethoxymethane).</p>

End-use	Substitute	Decision	Further Information ¹
	HFO-1336mzz(Z) ((Z)-1,1,1,4,4,4-hexafluorobut-2-ene, Formacel® 1100)	Acceptable	<p>HFO-1336mzz(Z) (CAS Reg. No. 692-49-9) has no ozone depletion potential (ODP) and a 100-year GWP of roughly 9.</p> <p>This compound is nonflammable.</p> <p>The manufacturer recommends an acceptable exposure limit of 500 ppm over an 8-hour TWA for HFO-1336mzz(Z).</p>
Rigid polyurethane commercial refrigeration and sandwich panels	Methylal (dimethoxymethane)	Acceptable	<p>Methylal (CAS Reg. No. 109-87-5) has a 100-yr GWP of less than three. This substitute is flammable and meets the definition of a flammable Class IB fluid under OSHA's regulations at 29 CFR 1910.106.</p> <p>The ACGIH has established a TLV of 1,000 ppm (8-hr TWA) for methylal (dimethoxymethane).</p>
	HFO-1336mzz(Z) ((Z)-1,1,1,4,4,4-hexafluorobut-2-ene, Formacel® 1100)	Acceptable	<p>HFO-1336mzz(Z) (CAS Reg. No. 692-49-9) has no ODP and a 100-year GWP of roughly 9.</p> <p>This compound is nonflammable.</p> <p>The manufacturer recommends an acceptable exposure limit of 500 ppm over an 8-hour TWA for HFO-1336mzz(Z).</p>
Rigid polyurethane slabstock and other	Methylal (dimethoxymethane)	Acceptable	<p>Methylal (CAS Reg. No. 109-87-5) has a 100-yr GWP of less than three. This substitute is flammable and meets the definition of a flammable Class IB fluid under OSHA's regulations at 29 CFR 1910.106.</p> <p>The ACGIH has established a TLV of 1,000 ppm (8-hr TWA) for methylal (dimethoxymethane).</p>

End-use	Substitute	Decision	Further Information ¹
	HFO-1336mzz(Z) ((Z)-1,1,1,4,4,4-hexafluorobut-2-ene, Formacel® 1100)	Acceptable	<p>HFO-1336mzz(Z) (CAS Reg. No. 692-49-9) has no ODP and a 100-year GWP of roughly 9.</p> <p>This compound is nonflammable.</p> <p>The manufacturer recommends an acceptable exposure limit of 500 ppm over an 8-hour TWA for HFO-1336mzz(Z).</p>
Flexible polyurethane	Methylal (dimethoxymethane)	Acceptable	<p>Methylal (CAS Reg. No. 109-87-5) has a 100-yr GWP of less than three. This compound is flammable and meets the definition of a flammable Class IB fluid under OSHA's regulations at 29 CFR 1910.106.</p> <p>The ACGIH has established a TLV of 1,000 ppm (8-hr TWA) for methylal (dimethoxymethane).</p>
	HFO-1336mzz(Z) ((Z)-1,1,1,4,4,4-hexafluorobut-2-ene, Formacel® 1100)	Acceptable	<p>HFO-1336mzz(Z) (CAS Reg. No. 692-49-9) has no ODP and a 100-yr GWP of roughly 9.</p> <p>This compound is nonflammable.</p> <p>The manufacturer recommends an acceptable exposure limit of 500 ppm over an 8-hour TWA for HFO-1336mzz(Z).</p>
	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E))	Acceptable	<p><i>Trans</i>-1-chloro-3,3,3-trifluoroprop-1-ene (CAS Reg. No. 102687-65-0) has an ODP of approximately 0.00024 to 0.00034. It has a 100-year GWP of 1 to 7.</p> <p>This compound is nonflammable.</p> <p>The American Industrial Hygiene Association has established a workplace environmental exposure limit of 800 ppm (8-hr TWA) for <i>trans</i>-1-chloro-3,3,3-trifluoroprop-1-ene.</p>

End-use	Substitute	Decision	Further Information ¹
Integral skin polyurethane	Methylal (dimethoxymethane)	Acceptable	<p>Methylal (CAS Reg. No. 109-87-5) has a 100-yr GWP of less than three. This substitute is flammable and meets the definition of a flammable Class IB fluid under OSHA's regulations at 29 CFR 1910.106.</p> <p>The ACGIH has established a TLV of 1,000 ppm (8-hr TWA) for methylal (dimethoxymethane).</p>
	HFO-1336mzz(Z) ((Z)-1,1,1,4,4,4-hexafluorobut-2-ene, Formacel® 1100)	Acceptable	<p>HFO-1336mzz(Z) (CAS Reg. No. 692-49-9) has no ODP and a 100-yr GWP of roughly 9.</p> <p>This compound is nonflammable.</p> <p>The manufacturer recommends an acceptable exposure limit of 500 ppm over an 8-hour TWA for HFO-1336mzz(Z).</p>
Phenolic insulation board and bunstock	HFO-1336mzz(Z) ((Z)-1,1,1,4,4,4-hexafluorobut-2-ene, Formacel® 1100)	Acceptable	<p>HFO-1336mzz(Z) (CAS Reg. No. 692-49-9) has no ODP and a 100-year GWP of roughly 9.</p> <p>This compound is nonflammable.</p> <p>The manufacturer recommends an acceptable exposure limit of 500 ppm over an 8-hour TWA for HFO-1336mzz(Z).</p>

¹ Observe recommendations in the manufacturer's MSDS and manufacturer's guidance for using all listed foam blowing agents.

Fire Suppression and Explosion Protection

End-Use	Substitute	Decision	Further Information
Total flooding (occupied and unoccupied areas)	Powdered Aerosol D (Aero-K®, Stat-X®)	Acceptable	<p>Use of this agent should be in accordance with the safety guidelines in the latest edition of the National Fire Protection Association 2010 standard for Aerosol Extinguishing Systems.</p> <p>For establishments manufacturing the agent or filling, installing, or servicing containers or systems to be used in total flooding applications, EPA recommends the following:</p> <ul style="list-style-type: none"> - the appropriate safety and personal protective equipment (PPE) (e.g., protective gloves, tightly sealed goggles, protective work clothing, and particulate-removing respirators with National Institute for Occupational Safety and Health type N95 or better filters) consistent with Occupational Safety and Health Administration (OSHA) guidelines should be used during manufacture, installation, servicing, and disposal of total flooding systems using the agent; - adequate ventilation should be in place to reduce airborne exposure to constituents of agent; - an eye wash fountain and quick drench facility should be close to the production area; - training for safe handling procedures should be provided to all employees that would be likely to handle containers of the agent or extinguishing units filled with the agent; - workers responsible for clean up should allow for maximum settling of all particulates before reentering area and wear appropriate personal protective equipment; and - all spills should be cleaned up immediately in accordance with good industrial hygiene practices. <p>As required by the manufacturer, units installed in normally occupied spaces will be equipped with features such as a system-isolate switch and cross-zone detection system to reduce risk of accidental activation of an agent generator while persons are present in the protected space. Also required by the manufacturer is warning of pending discharge and delay in release to ensure egress prior to activation of the agent to reduce the risk of exposure.</p> <p>See additional comments 1, 2, 3, 4, 5.</p>

1. The EPA recommends that users consult Section VIII of the OSHA Technical Manual for information on selecting the appropriate types of personal protective equipment for all listed fire suppression agents. The EPA has no intention of duplicating or displacing OSHA coverage related to the use of personal protective

equipment (e.g., respiratory protection), fire protection, hazard communication, worker training or any other occupational safety and health standard with respect to halon substitutes.

2. Use of all listed fire suppression agents should conform to relevant OSHA requirements, including 29 CFR part 1910, subpart L, sections 1910.160 and 1910.162.
3. Per OSHA requirements, protective gear (SCBA) should be available in the event personnel should reenter the area.
4. Discharge testing should be strictly limited to that which is essential to meet safety or performance requirements.
5. The agent should be recovered from the fire protection system in conjunction with testing or servicing, and recycled for later use or destroyed.

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